



# CSIR NEWS

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## Utilization of Processes Developed by CSIR Laboratories

The efforts of the Council of Scientific & Industrial Research (CSIR) in forging close links with industries have helped in securing utilization of many processes evolved by the national laboratories. Two hundred and eighty-seven processes were released for commercial utilization up to 1967-68 on royalty/premium basis or as technical assistance against payment. Of these, 144 processes were in production and 143 were in various stages of commercial development. Twenty-three processes provided as technical assistance free of charge were adopted by industry on a commercial scale. Thirty-three processes were under semi-commercial or pilot production on the prototype plants of the laboratories. These details are provided in the publication titled 'Data on Research Utilization 1967-68', which has just been released by the Research Coordination & Industrial

Liaison Division of CSIR. Latest figures now available show that till Dec. 1969, the Council's laboratories had released 371 processes to industry of which 164 processes are being utilized by industry.

### Engineering and Consultancy Service

Adequate facilities by way of expertise, pilot plants and equipment have been built up at the laboratories for providing design, engineering and consultancy service to industry. Besides providing technical service on their own processes, CSIR laboratories also offer consultancy assistance in a general way to industry. These include: (1) technical consultancy, primarily for solution of working problems of operation or raw materials; (2) undertaking survey, feasibility and project studies; (3) designing, fabrication or repairs of equipment and machinery; (4) assistance in

planning and execution of projects; and (5) designing and testing of bridges and structures.

Besides, the laboratories have been giving technical assistance and advice free of charge to government departments, public sector undertakings and a large number of small scale industries.

### Standardization and Quality Control

The laboratories are equipped with adequate facilities to undertake testing and analysis of raw materials and finished products, and calibration and repair of instruments. These facilities are being increasingly utilized by industries and government departments.

The trend in utilization of CSIR processes, and consultancy and testing services are given in Table.

### Industrial Liaison

The information units of the laboratories and the Research Coordination and Industrial Liaison Division at

Table — Trends in Utilization of CSIR Processes, and Consultancy and Testing Services  
(Value or fee in Rs lakhs)

	NO. OF PROCESSES IN PRODUCTION			CONSULTANCY SERVICES		TESTING OF SAMPLES AND INSTRUMENTS	
	By industry	By CSIR laboratories	Value	No.	Fee	No.	Fee
1964-65	54	32	282	19	2.40	25,843†	3.32
1965-66	77	41	311	65	5.80	28,589†	5.76
1966-67	103	58	453	123	6.30	28,468†	7.69
1967-68	144	33	499*	76	3.94	25,175	8.21

\*Partial figures

†Figures for calendar years 1964, 1965 and 1966 respectively



the headquarters handle a number of enquiries received from individuals and industries. The enquiries relate mostly to processes and products, technical data, standards and specifications. The number of such enquiries attended to during 1967-68 was over 15 000, and nearly 1000 technical and non-technical notes were prepared and sent.

The Council's laboratories have been encouraging the participation of industries and user organizations in scientific and industrial research, and this is reflected by the number of schemes and projects sponsored by them. During 1967-68, 178 schemes financed wholly or partially by the sponsoring authorities were in operation in 18 national laboratories. Work on 39 such schemes was completed. These schemes primarily relate to the development of processes

for new products; upgrading, standardization and utilization of indigenous raw materials and solution of specified problems. The laboratories also undertook investigations on 68 schemes/items of work particularly at the instance of public sector undertakings without any financial participation. Thirty-nine schemes on basic research were in operation in 11 CSIR laboratories during 1967-68 and these were financed mainly by international organizations and government departments. Revenue accruing to CSIR during 1967-68 from analysis, testing and other services totalled Rs 8 20 640. Latest data show that the revenues from, testing and analysis during 1969 amounted to above Rs 9.55 lakhs. The total income of CSIR during 1969 from royalties, premia, consultancy, testing, analysis, etc. amounted to over Rs 30 lakhs.

helices was almost immediately accepted, and a general theory of the X-ray pattern to be expected from such helices was given by Cochran, Crick and Vand. The idea that there is no need at all for the number of residues to be rational and that its magnitude is determined only by stereochemical considerations was propounded by Ramachandran. Based on such stereochemical ideas, a structure was proposed for the protein, collagen, by Ramachandran and his coworkers at the Centre of Advanced Study in Biophysics, Madras. This has gone through several refinements and is now accepted to be basically correct.

### Principles of Biopolymer Folding

A helix is a commonly occurring form of folding of a polymer chain. It is interesting to note that the motion of a rigid body, when it is brought from one place to another with a different orientation, has in fact a helical symmetry. Such a motion has the screw motion as the element of symmetry, and its successive applications would result in a helical symmetry for the structure. In the case of polypeptide chains which occur in proteins, this effect is produced by the action of rotations about single bonds of the planar peptide units. This method of analysing protein 'conformations' in terms of dihedral angles of rotation was developed in 1962-63 by Ramachandran's group in Madras, and forms the basis of the approach adopted nowadays for the study of biopolymer folding in general. Some specific applications are as follows.

*Polypeptide chains*—Studies made at the Madras Centre have indicated what types of helices are possible for a polypeptide chain. The most important of such stable helices are the standard right-handed alpha helix, the collagen helix, silk helix (beta structure). It is interesting that only these three different types of regular structures are observed in fibrous proteins.

*Polysaccharides*—The repeating unit in a polysaccharide is the six-membered ring of a glucose sugar residue and two types of such sugar residues are possible, viz.  $\alpha$ - and  $\beta$ -glucose.

## Molecular Biophysics and Crystallography

Krishnan Memorial Lecture  
by Prof. G. N. Ramachandran

The sixth Krishnan Memorial Lecture was delivered by Prof. G. N. Ramachandran, Jawaharlal Nehru Fellow and Director, Centre of Advanced Study in Biophysics, University of Madras, Madras at the National Physical Laboratory, New Delhi on 16 Feb. 1970.

Prof. Ramachandran observed that molecular biophysics is a field of comparatively recent origin and the methods of approach adopted by molecular biophysicists have turned out to be immensely fruitful in the evolution of new methods in crystallography—not only in the solution of crystal structures, but also in understanding the stability of periodic structures occurring in crystals.

### Stereochemistry and Helical Chains of Proteins

Early studies of biomolecular structures were confined to those

cases in which the molecular chain exhibited some simple symmetry, like those of cellulose, silk, and stretched hair, where the polymer chain had the symmetry of a two-fold screw axis. The interpretation of X-ray patterns of other proteins like those in muscle, or wool, or tendon, was long delayed because of a central dogma held in crystallography, viz. that a molecular structure in the solid state can have only screw axes of the order of 2, 3, 4 and 6. The change in attitude came as a result of a very slow evolution spread out over nearly a decade and was initiated by the revolutionary concept inaugurated by Pauling and Corey, who showed that a very stable type of folding of the polypeptide chains is possible having a non-integral number of residues per turn, namely 3.6 to 3.7. This structure, called the alpha helix, is found in various proteins and a vast majority of synthetic polypeptides. Pauling's idea of non-integral





Prof. G. N. Ramachandran, Jawaharlal Nehru Fellow, delivering the sixth Krishnan Memorial Lecture at NPL

An interesting aspect of polysaccharide chemistry is that the  $\beta$ -polysaccharides, such as cellulose, are highly insoluble in water and are not digested by human beings, while the  $\alpha$ -polysaccharides (e.g. starch) form the essential food material for human beings. At the suggestion of the Centre, a study has been initiated (involving six laboratories all over the country) to work out methods whereby the farm waste materials, which are essentially in the form of cellulose, may be broken down into sugars and then converted into protein food. If this succeeds, then practically the whole of the plant kingdom, including wood, stalk and leaves of the plants, may one day be converted into food suitable for human beings.

*Nucleic acids*—The other well-known biopolymer is the nucleic acid, essential for genetics, whose repeating unit, however, is not rigid. The basic ideas of carrying out rotations inside the unit have been developed in the Madras laboratory and have served to explain the occurrence of various types of helices in nucleic acids.

### Non-helical Association in Biopolymers

Unlike collagen, in which the chains may have a thousand units, or nucleic acids, which may sometimes have a million units, the biologically active protein chains have between 50 and 300 units and should be considered to be finite molecules, rather than as macromolecules. These protein chains exhibit a variety of conformations, containing sometimes portions of  $\alpha$ -helices and sometimes portions of the  $\beta$ -structure. All these are folded together in a complicated manner, leading to a compact globular structure for the molecule as a whole. From a calculation of the energy of interatomic interactions between the various atoms and groups in such a structure, the theoretical deduction of the stable conformation can be made, by finding the one which has a minimum value for this energy.

Because of lack of precise physical data to evaluate the validity of the theories that are available, a large amount of theoretical as well as experimental studies dealing with molecular interactions has been and

is being made in various laboratories, including at Madras, on simpler crystal structures.

### Formation of Periodic and Symmetric Structures by Aggregation of Particles

If a set of identical particles is connected in a linear fashion, such that successive ones are in a specific relative orientation, then the resulting structure is, in general, a helix. It is impossible to have a two-dimensional network of connections between such particles if there are only two linking points per particle, one of which may be called the donor and the other the acceptor.

A problem to be tackled in three dimensional structures is to know the minimum number of linkages per particle that is needed to build an extended, stable structure. The structures with the smallest number of neighbours that are known so far have four edges meeting at a vertex, e.g. the diamond structure. These are highly open structures. In most close-packed structures in three dimensions, the number of neighbours is large, namely 8 to 12 or more. It is well known from crystal structure studies that the best close-packing that is possible for a periodic structure involves a coordination number of 12, which exists, for instance, in the face-centred cubic (f.c.c.) and the hexagonal close-packed structures. However, if the packing of just 12 neighbours around a central sphere is considered, there appears to be a slight superiority in the icosahedral packing to the f.c.c. packing.

It is rather interesting that, although the five-fold axis which occurs in an icosahedron is not a permissible symmetry element of a crystal lattice, icosahedrally coordinated units have been observed in some crystal structures. In fact, many virus particles have this icosahedral symmetry, the subunits within them being packed with this symmetry. Also, several biological species have structures which have a five-fold symmetry, e.g. the five petals of a flower, and in some sea animals. The origin of such a five-fold symmetry in biological systems is certainly a very interesting and fruitful field for study.



# NPL Merit Awards

## Awards for Developing Electrostatic Photocopying Machine and High Permeability Ferrites

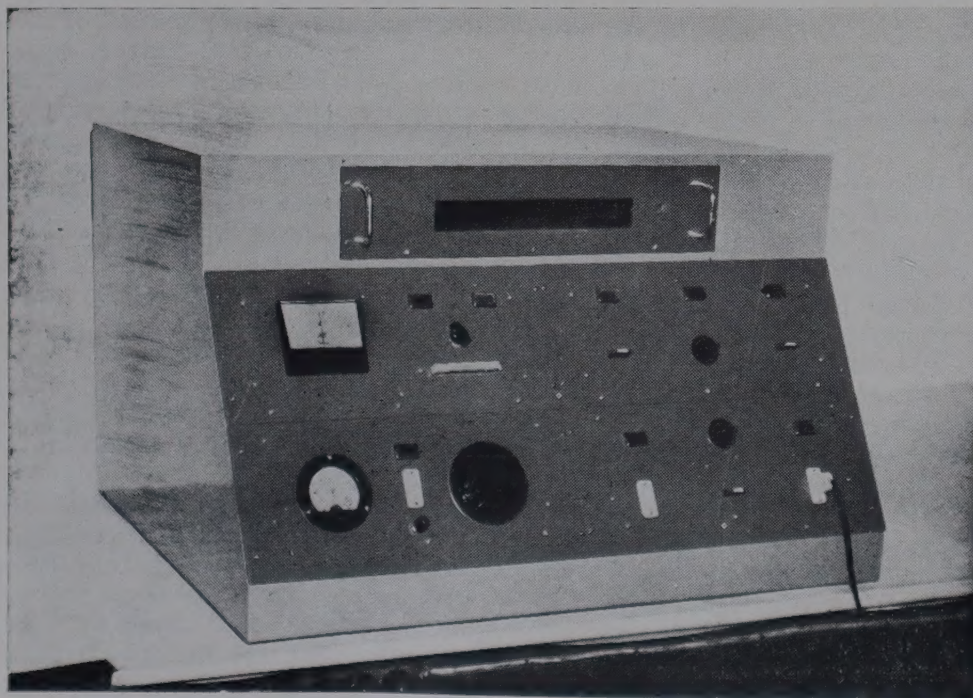
The National Physical Laboratory (NPL), New Delhi has instituted from 1970 two merit awards to be given every year to the scientists of the laboratory, who have done outstanding work during the year. One of the awards carries a cash prize of Rs 2000 and the other Rs 1000. The awards will be presented to the scientists on the occasion of the Krishnan Memorial Lecture which the laboratory organizes every year. The awards are donated by Shri T. V. Ramamurti, Scientist Incharge, Development-cum-Production of Electronic Components Unit of NPL, from his share of royalty accruing from the processes developed by him and his colleagues, and released to industry.

Merit awards for 1970 were given to two teams of scientists. Drs P. C. Mehendru, D. C. Parashar and G. D. Sootha and Sarvashri Devendra Singh and Narendra Kumar were jointly awarded the prize of Rs 2000 for developing an electrostatic photocopying machine. The

second award of Rs 1000 went to a team comprising Sarvashri T. V. Ramamurti, N. Radhakrishnan Nair, R. S. Khanduja, Bachan Singh and S. Ramanathan for developing high permeability ferrites. Prof. G. N. Ramachandran, Jawaharlal Nehru Fellow and Director, Centre of Advanced Study in Biophysics, Madras University, Madras, who delivered the sixth Krishnan Memorial Lecture, presented these awards at NPL, New Delhi on 16 Feb. 1970.

### Electrostatic Photocopying Machine

The machine developed uses an electrostatic printing technique, popularly known as Xerography, for copying documents on ordinary paper by a dry process and employs a re-usable photo-sensitive plate. It has been fabricated with indigenously available components. The cost of the finished machine is estimated at about Rs 15 000, whereas the imported machine costs about Rs 1 lakh.



Electrostatic photocopying machine developed by NPL. It copies documents on ordinary paper by a dry process and employs a re-usable photo-sensitive plate. The device is useful for reproduction of documents and diagrams quickly and at low cost

Xerographic process is a direct positive-to-positive photographic process. The re-usable plate employed in this machine is made by vacuum depositing several layers of photo-sensitive materials on an aluminium sheet. The plate is sensitized by electrostatic charging before it is exposed in a camera to the document to be copied. The latent image is developed when it is dusted with an oppositely charged dye. A sheet of ordinary paper is placed on the developed plate and then charged electrostatically in a manner similar to the one used for sensitizing the plate. The image thus gets transferred to the paper and is then fixed either by heat or by chemical treatment.

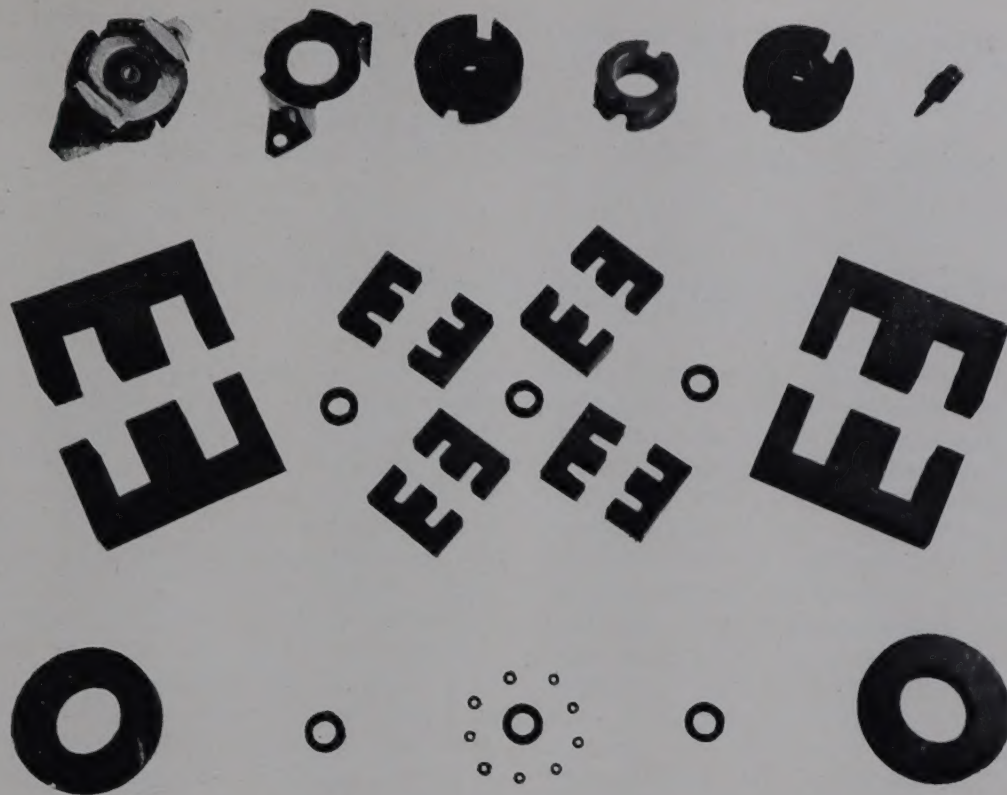
The equipment is an extremely useful device for the production of clean and dry copies of documents and diagrams quickly and at a fraction of the cost of photocopies. This Xerographic machine, at its modest cost, would be a very useful facility for educational institutions, research establishments and libraries in India.

### High Permeability Ferrites

The high permeability professional grade ferrites developed are in great demand in the telecommunications industry. The ferrites developed had to be equivalent to the imported Philips 3B7, the specifications for which are very stringent. Several testing techniques such as X-rays, optical microscopic, spectro-chemical analysis, Mossbauer spectroscopy, etc. were brought to bear on the problem. As a result of the interdisciplinary approach, the process for the professional ferrites was developed in a short time. Joint testing at the Telecommunication Research Centre, New Delhi has shown that the NPL ferrites meet all the requirements and substitute the imported material. The characteristics of one of the NPL samples (No. 209-104-2) are : initial permeability, 2832; disaccommodation factor,  $2.15 \times 10^{-6}$ ; hysteresis factor, 0.73; loss factor (at 4 kc/s),  $0.72 \times 10^{-6}$ —(at 100 kc/s),  $2.34 \times 10^{-6}$ ; and temperature factor,  $+0.576 \times 10^{-6}$ .

These ferrites are used not only in telecommunications, but also in





Some high permeability ferrites, used in telecommunication equipment, computers, etc., developed by NPL

tape recorders, memory cores for computers, etc. The equipment required for processing the material, viz. controlled atmosphere furnace, temperature programmers and complicated dies were designed and fabricated in the laboratory itself.

The demand for these ferrites in the telecommunication industry is

estimated roughly at 10 tonnes, which is likely to go up to 25 tonnes in the next few years. These ferrites are also used in TV receivers, each receiver requiring some 400-500 g. of ferrite. As the TV industry is gradually growing, there is bound to be increase in the demand for this type of ferrite material. The approximate price of the corresponding imported material is Rs 1 50 000/tonne.

## CSIR SUPPORT TO RESEARCH

### Completed Schemes

#### Studies on Alkaloids from *Arundo donax* and *Abrus precatorius*

A CSIR-sponsored scheme entitled 'Studies on the active principles of some Indian medicinal plants belonging to the families *Graminae* and *Leguminosae* and organic reaction mechanism' was completed at the Department of Pharmaceutics, Banaras Hindu University, Varanasi. Dr S. Ghosal, Reader in the Department, was the investigator-in-charge with Shri S. K. Dutta as the junior research fellow.

**Phytochemical investigations**—The tryptamine type indole bases are widely distributed in the plant kingdom. Among the families which are known to elaborate this group of alkaloids, *Graminae* and *Leguminosae* are prominent. In order to confirm the findings of the previous work and to extend the knowledge of the content and distribution of the indole bases in two common Indian species belonging to the families *Graminae* and *Leguminosae*, the alkaloidal constituents of *Arundo donax* Linn. (*Graminae*) and *Abrus precatorius* Linn. (*Leguminosae*) were investigated.

Eight simple indole bases were isolated from different parts of *A. donax*. These are N, N-dimethyltryptamine and its N(b)-oxide, gramine and its N(b)-oxide, 5-methoxyl-N-methyltryptamine, bufotenine, bufotenidine and dehydrobufotenine. The last two alkaloids were obtained for the first time from a plant source. The only other natural source known for these two compounds was the toad poison. Gramine-N-(b)-oxide was known as a synthetic compound until now.

*A. precatorius* yielded four alkaloids, viz. abrine, hypaphorine, trigonelline and trigonelline gallate, besides choline. Trigonelline occurs widely in the family *Leguminosae*; it was obtained for the first time from the plant as a salt of an organic acid—trigonelline gallate. Hypaphorine was previously known to occur only in the genus *Erythrina* (*Leguminosae*).

The principle of 'localization of the substances isolated' was followed in the present investigation and all the individual parts such as the flowers, seeds, leaves, stems, rhizomes and roots of these two plants were separately worked up for their alkaloidal contents. Gramine, the major alkaloid of the flowers and leaves of *A. donax*, is totally missing in the rhizomes. Bufotenidine and dehydrobufotenine, the two major constituents of the rhizomes, are absent in other parts of the plant. Investigation with *A. precatorius* also revealed some interesting features. Abrine occurs as the major nitrogenous constituent in all parts of the plant except the pods in which it is absent. The pods contain only trigonelline. White seeds of *A. precatorius* are devoid of trigonelline and its gallate. The synthesis of trigonelline in *A. precatorius* was found to be maximum during the seeding.

The co-occurrence of several N(b)-alkylated tryptamines having 5-hydroxy- or 5-methoxy- substituents, viz. N, N-dimethyltryptamine and its 5-oxygenated analogues in *A. donax* together with the conspicuous absence of serotonin in this species lends credence to a prevailing hypothesis that N, N-dimethyltryptamine (or equivalent) but not serotonin, is the common intermediate in the genesis of these tryptamines in plants.



**Pharmacological screening**—The total extractives as well as the individual indolic bases isolated from the different parts of *A. donax* were subjected to pharmacological screening. Bufotenidine, the major alkaloidal constituent of *A. donax*, showed very little CNS activity. On the other hand, the alkaloid showed a strong curare-like action both *in vitro* and *in vivo*, this activity is almost equipotent to tubocurarine activity *in vitro*. Bufotenidine possessed stimulant activity on smooth muscles. Bufotenidine and the other tryptamines, isolated from *A. donax*, showed antihypertensive action on dog's carotid blood pressure.

**Oxidation of *N,N*-dimethylaniline**—The course of oxidation of *N,N*-dimethylaniline (DMA) with iodine in methylene chloride, water (as the second phase), and *n*-heptane has been studied. The results indicate the formation of a 1:1-DMA-I<sub>2</sub> molecular complex of the amine halogen donor-acceptor type at the initial stage of the reaction. The charge-transfer complex changes slowly in methylene chloride and rapidly in water into crystal violet cation. The spectral changes indicate nuclear iodination of DMA through the DMA-I<sub>2</sub> ionic complex, *p*-iododimethylaniline being an intermediate in this reaction.

**Chemistry of 3-phenyloxindoles**—Treatment of mandelic anilide with concentrated sulphuric acid yielded a mixture of 3-phenyloxindole and a dimeric lactam. Substituted mandelic anilides also gave similar products under comparable conditions. The relative yields of these products depended on the time allowed for the cyclization. The nature of these transformations was studied in detail. 3-Phenyloxindole was found to be the intermediate in the autoxidation of 2-benzyl-3-phenylindole to 3-phenyldioxindole.

**Oxidation of 3-phenyloxindoles to 3-phenyldioxindoles**—A remarkable property of 3-substituted oxindoles is the ease with which the C<sub>3</sub>-hydrogen is replaced by hydroxyl, in the presence of air, to give the corresponding dioxindoles. Based on this property, several 3-phenyldioxindoles have been prepared. The intermediates obtained in such oxidations

would help to understand the metabolism of tryptophan in biological systems.

Shri Dutta submitted a thesis en-

titled 'Phytochemical investigation of *Abrus precatorius* and *Arundo donax* and oxidation studies' to the Banaras Hindu University and was awarded the Ph.D. degree in 1969.

## Studies on Treatment of Distillery Waste Effluents

Dr A. K. Basu, Scientist, Central Public Health Engineering Research Institute, Calcutta Zonal Centre, Calcutta carried out these studies in the Department of Industrial Chemistry, University of Leige, Belgium under the guidance of Prof. Edmond Leclerc, Head of the Department, on a research fellowship from the Belgium Ministry of Education and International Culture, Brussels for a period of two years.

The study of the nature and composition of beet molasses distillery waste in Belgium shows that it is highly charged with organic matter and toxic materials and is hazardous from the pollution point of view.

The object of the study was to find out suitable means of treatment, by aerobic (trickling filter) and anaerobic digestion studies, to lessen pollution. For the first time Flocor plastic material was successfully employed as a trickling filter packing medium for the treatment of this type of waste. Laboratory scale treatment studies revealed that the Flocor plastic packing serves well as a roughing material, to withstand an organic loading of about 7 kg/m<sup>3</sup>.d with about 43% BOD reduction. The efficiency of BOD removal could be improved to about 65% at an organic load of 1.7 kg/m<sup>3</sup>.d. In contrast to this, the conventional stone filter gives a purification of 90-93% BOD removal at an organic loading of 0.152-0.228 kg/m<sup>3</sup>.d.

It is not possible to treat beet molasses distillery waste by batch anaerobic digestion. However, with the adoption of conventional anaerobic digestion the efficiency of purification considerably improves. A BOD reduction of 80.5% at an organic loading of 3 kg/m<sup>3</sup>.d corresponding to a retention time of 10 days was observed. Further improvement could be achieved if high rate anaerobic

digestion is employed at 35°C. Employing an organic loading of 3.2 kg/m<sup>3</sup>.d corresponding to a retention time of 10 days the observed BOD removal was 96% with a higher yield of gas (CH<sub>4</sub> being 59-64%). Almost identical results (with slight improvement in conventional digestion) were observed at anaerobic digestion at 55°C. In view of the cost involved to maintain digestion at higher temperature, the high rate digestion at 35°C should be the practical solution for anaerobic digestion.

The study revealed some interesting observations which could be useful in full scale plant to abate pollution or to reduce the cost of pollution treatment. The choice of treatment between aerobic and anaerobic studies or both depended mainly on the purpose and local conditions. If the sole objective is to reduce the BOD to a low level, conventional stone filter (low loading) should serve the purpose. On the contrary, if the object is to reduce the organic loading to an existing treatment plant then the Flocor plastic material trickling filter (high loading) method should be the choice of treatment. Anaerobic digestion at 35°C could also be employed on full scale plant provided a secondary means of further treating the effluent from such plant is adopted as a complementary treatment method. The methane obtained from such treatment could probably be used as a fuel for heating the digestors or otherwise. The sludge yield was insignificant in anaerobic digestion studies as compared to aerobic trickling filter studies, especially trickling filter using Flocor as plastic material.

Dr Basu was conferred the D.Sc. (Applied Sciences) degree by the University of Leige, Belgium for his thesis: 'Contribution to the studies of treatment of distillery waste water'.



# PROGRESS REPORTS

## CFTRI Annual Report 1968

Work carried out in collaboration with the Department of Food, Government of India, in the evaluation of modern rice mills and with the Food Corporation of India in the utilization of the modern method of parboiling paddy is of particular significance in promoting optimal utilization of the food resources of the country. The annual report of the Central Food Technological Research Institute (CFTRI), Mysore for 1968, just published, reveals that this work has helped the government to formulate its new rice milling policy for raising the output and more effectively utilizing the byproducts. The important lines of research that were in progress during the year are briefly outlined.

### *Cereals and Pulses*

Pilot plant work was carried out on the various unit operations in rice milling with a view to improving productivity and quality. Priority was given to the development of a suitable destoner, rubber roller sheller and paddy separator. New techniques of dehushing and splitting pulses are being tested in a pilot plant unit designed for modernization of this industry. Large scale mill trials were also carried out for improving the sun drying procedure for parboiled paddy. Drying of paddy in two stages with a 3 hr break at 16-18% moisture level practically eliminated breakage during milling. The sources of breakage in the milling of rice were studied and traced ultimately to cracked and defective kernels, which indicates the importance of premilling factors.

In fortification studies, it was found that added lysine is fairly stable in many dishes like *chapati* as compared with bread which is baked at high temperature for longer time. The protein efficiency ratio of products made from *atta* fortified with 0.15% lysine was higher than that of unfortified *atta*.

### *Foodgrain Storage*

Studies on the use of aluminium phosphide for fumigation of food-

grains showed that apart from the survival of immature stages of pests, chemisorption of phosphine in the commodities is of high order. Other studies carried out during the year relate to : isolation and identification of a new isomer of hexachlorocyclohexane from the X-factor isolated from crude BHC earlier; development of a new gas mask canister-filling for protection against phosphine having longer service time; and successful testing of magnesium ammonium arsenate, a byproduct of fertilizer industry, against field and domestic rats. Commercial prototype units were designed for studying pilot plant production of pesticidal formulations, insecticidal clays and strip packaging of fumigant tablets for use in domestic and farm storages.

### *Protein Foods and Oilseeds*

Efforts were intensified to promote large scale production of Lac-tone (animal milk toned with groundnut protein isolate); a plant (capacity, 1000 litres) is operating at Bangalore since March 1968. Laboratory studies were completed for preparing edible oil (oil content, 10%) from black sesame seeds. A debittered mustard meal with low fibre content and about 50% protein was also prepared on a laboratory scale.

### *Fruit and Vegetables*

The hot water treatment for accelerating ripening and control of fungal damage, successfully tested on 100 tons of alphonso mangoes in a processing factory at Bangalore, cut down the spoilage of mangoes from 20% to 5%. The institute developed an indigenous chemical paste for preserving fresh bananas for export.

Three types of indigenous Rourkela tin plates were tested for substituting imported tin plate for food canning, and found suitable for packing green peas, cabbage, potatoes and tomato and orange juice.

### *Research Utilization*

Eleven processes/products were released for commercial production :

ready mixes, high protein biscuits, durobase-3 formulations, process for manufacture of fruit bars, process for manufacture of mango cereal flakes, egg coating oil, egg washing powder, egg washing machine, garlic powder, pectin from papaya and tamarind juice concentrate.

One hundred research and review papers were published. Seven patents were filed and the following patent was accepted : improvements in or relating to the detoxification of foodstuffs containing aflatoxin.

## Trend Recognition Techniques in Geoscientific Problems

### Special Lectures at NGRI

A series of four lectures on the topic were delivered by Dr S. V. L. N. Rao, Assistant Professor of Geology, Indian Institute of Technology, Kharagpur at the National Geophysical Research Institute, Hyderabad from 22 to 24 Dec. 1969.

As an introduction, Dr Rao discussed the applicability of numerical methods in geology, geophysics and geochemistry emphasizing their utility in exploration and prospecting for mineral deposits. Location of mineral deposits needs development of methods for interpolation and extrapolation of the parameters from the data available for study. While techniques of interpolation are more straightforward, many difficulties crop up in extrapolating the behaviour of parameters in variable space. In order to understand the behaviour of parameters in variable space, two methods of investigation could be used, i.e. the trend surface method (based on least squares summation principle) or the moving averages method. In applying these techniques, the models conceived for this purpose should be based on certain assumptions. Though the methods of computation are different, since the underlying assumptions are the same, they portray the same phenomenon. By using such methods, one can filter out noise and study the trends. The noise component constitutes the anomaly and in certain studies (such as in gravity or trace element distribution), these noise zones need scrutiny.

In many geoscientific studies, the data are resultant of multiple set of



responses. In such cases, it is not possible to use these techniques in a routine manner to decompose the various response units. Geoscientists use both scalar and vectorial data. To compare these data matrices, it is necessary to project them in stereograms. Prof. Rao also dealt with the methods of comparing the spatial profiles obtained from scalar and vectorial data matrices.

### Prof. N. R. Kuloor

We regret to record the demise on 5 Feb. 1970 of Prof. N. R. Kuloor, Professor and Head of the Department of Chemical Engineering, Indian Institute of Science, Bangalore.

Prof. Kuloor had his early education at the University of Bombay. He had his Ph.D. degree in chemical engineering from the University of London in 1947. Prior to his joining the Indian Institute of Science in May 1960, he was Director, Shri Ram Institute for Industrial Research, Delhi where he worked from 1947 to 1960. Prof. Kuloor had been associated with a number of industrial establishments, including the Tata Chemicals, Mithapur; Eastern Chemical Works Ltd, Bombay; Gas Company, Imperial Chemical Industries, Mossend; M. W. Kellogg Co., Jersey City & New York; and Foster D. Snell Inc., New York.

Prof. Kuloor's main interest was in the areas of (i) process development and reaction engineering; (ii) thermodynamic and transport properties; and (iii) heat, mass and momentum transfer. He has more than 250 papers to his credit, besides 40 patents in the above fields.

Prof. Kuloor was closely associated with the Council of Scientific & Industrial Research as a member of the Chemical Research Committee and the Chemical Engineering Research Committee, and member, Editorial Boards, *Journal of Scientific & Industrial Research* and *Indian Journal of Technology*. He was the investigator-in-charge of a number of CSIR research schemes sponsored at the Indian Institute of Science, Bangalore.

## PATENTS

### FILED

124511: Improvements in or relating to preparation of crosslinked polymers and derivatives thereof, B. D. Dasare, R. Rajagopalan, P. B. Trivedi & N. Krishnaswamy — CSMCRI, Bhavnagar.

124573: Improvements in or relating to the preparation of interpolymer compositions and ion exchange membranes, K. P. Govindan & P. K. Narayanan — CSMCRI, Bhavnagar.

124757: A new dust formulation for the protection of stored grains from insect infestation, J. B. Srivastava—RRL, Jammu.

124758: Improvements in or relating to mechanical integrator, T. R. R. G. Rao & S. N. Ray — CMERI, Durgapur.

124893: Process for the preparation of methyl bromide, H. M. H. Bhavanagary & S. K. Majumder — CFTRI, Mysore.

124951: A hydraulic prop incorporating a load indicating device, R. N. Gupta, B. Singh & K. N. Sinha — CMRS, Dhanbad.

124994: Improvements in or relating to techniques for the manufacture of products of complicated shapes by extrusion method, G. D. Joglekar & C. L. Verma — NPL, New Delhi.

125137: A process for the recovery of microbial cells from petroleum hydrocarbon fermentation broth, S. P. Srivastava, J. N. Baruah, H. D. Singh, P. V. Krishna & M. S. Iyengar — RRL, Jorhat.

### ACCEPTED

114925: Coal modified tar binders for road construction works, S. Bagchee — CRRI, New Delhi.

114952: An electronic device for checking speed of automobiles on roads, C. S. Rangan & V. A. Abraham — NAL, Bangalore.

115041: Improvements in or relating to variable area flowmeter, P. Chanchanna — CMERI, Durgapur.

115087: Process of producing carbon or graphite in the form of wool, felt, yarn, fibre or textiles and the material produced thereby, S. S.

Verma, B. Bhushan & N. Roy — CGCRI, Calcutta.

115204: Improvements in or relating to electrolyte for tantalum electrolytic capacitors, B. A. Shenoj, K. R. Narasimhan, V. Lakshminarasimhan, A. Anantharaman & D. Kanagaraj — CECRI, Karaikudi.

115207: A flushing cistern, P. B. Rao & I. Singh — CBRI, Roorkee.

116841: A process for the synthesis of a plasticizer for polyvinylchloride resins, R. K. Bhatnagar & A. K. Jain — SRIFIR, Delhi.

117402: A self-powered mechanical salt harvester, R. P. Dhiman — CSMCRI, Bhavnagar.

118187: A process for preparation of resins from Pusa seedless variety of grapes, L. B. Singh & O. S. Sharma — NRG, Lucknow.

### SEALED

107982: Stable castable suspension of non-plastic almino-silicate materials and methods of making the same, A. V. Subrahmanyam & H. P. S. Murthy — NML, Jamshedpur.

108208: In and for a tractor mounted reciprocating mower, a combined break-back-cum-lifting arrangement, C. Mohan & B. S. Devgum — CMERI, Durgapur.

108209: Grip bars for concrete reinforcement, Z. George & G. S. Ramaswamy — SERC, Roorkee.

108270: Recovery of anhydrous sodium sulphate by flotation process, M. V. Chandorikar, D. J. Mehta & D. S. Datar — CSMCRI, Bhavnagar.

108343: Process for the preparation of potassium carbonate using ion exchange techniques, D. R. Baxi — CSMCRI, Bhavnagar.

108583: Chemically bonded forsterite refractories and methods of their preparation, M. C. Kundra & H. P. S. Murthy — NML, Jamshedpur.

109083: A process for imparting simultaneous improvements in flex abrasion resistance, tear strength and wet crease shedding properties to cellulosic textiles, V. B. Chipalkatti, N. B. Sattur, J. Varghese, H. C. Rastogi & R. C. Gupta — SRIFIR, Delhi.

109184: Processes for preparing coated fertilizers using lac as the primary coating material, K. M. Chakravarty, Retired Scientist, Ranchi.